CLAIMS

1. A non-invasive apparatus adapted to monitor parameters indicative of heart performance, said apparatus comprising:

At least one sensor adapted to continuously sense factors correlated with blood flow and collect data related to the flow of blood, said sensor is adapted to be positioned adjacent to a peripheral blood vessel;

a processor adapted to receive the collected data from said at least one sensor and calculate the parameters indicating heart performance;

a monitor on which the parameters indicating heart performance are displayed.

2. The apparatus as claimed in Claim 1, wherein said at least one sensor, said processor and said monitor are incorporated in a portable device, said portable device is adapted to be mounted on a body part in which a peripheral blood vessel passes.

3. The apparatus as claimed in Claim 2, wherein said portable device is worn on a wrist.

4. The apparatus as claimed in Claim 1, wherein said peripheral blood vessel is selected from a group of blood vessels such as a radial artery, a cubital artery, a tibial artery, a femoral artery and a carotid artery.

5. The apparatus as claimed in Claim 1, wherein one of said at least one sensor is a pressure sensor.

6. The apparatus as claimed in claim 1, wherein one of said at least one sensor is an electromagnetic sensor.

7. The apparatus as claimed in Claim 1, wherein said parameters indicating heart performance comprises stroke volume, cardiac output, and stroke work.

8. The apparatus as claimed in Claim 1, wherein said apparatus further comprises a means for transmitting the parameters indicating heart performance to external units.

9. The apparatus as claimed in Claim 8, wherein said means for transmitting is telemetry.

10. The apparatus as claimed in Claim 1, wherein said apparatus further comprises alarm means adapted to alert on irregularities in the blood flow.

11. The apparatus as claimed in Claim 10, wherein the alarm means is selected from the group consisting of audible alarm, visible alarm or vibrating alarm.

12. The apparatus as claimed in Claim 10, wherein the alarm is a beep sound.

13. The apparatus as claimed in Claim 10, wherein the alarm is a flashing light.

14. The apparatus as claimed in Claim 1, wherein said apparatus is provided with a socket through which the parameters indicating heart performance are electrically transmitted to an external processor, said external processor is electrically connected to a Holter system adapted to collect ECG signals.

15. The apparatus as claimed in Claim 14, wherein said external processor is provided with at least one algorithm, the algorithm is adapted correlate the data related to blood flow with the ECG signals in order to eliminate artifacts in the ECG signals.

16. The apparatus as claimed in Claim 14, wherein said processor is electrically communicating with a computer, said computer is provided with a storing means.

17. The apparatus as claimed in Claim 1, wherein one of said at least one sensor is temperature sensor.

18. The apparatus as claimed in Claim 1, wherein one of said at least one sensor is an ionic sensor, said ionic sensor is adapted to continuously measure changes in blood resistance due to a current induced on said blood vessel by a source electrode, and is adapted to interpret blood flow velocity from the blood resistance measurement.

19. The apparatus as claimed in Claim 1, wherein one of at least one sensor is an inertial sensor that detects the mechanical motion of said apparatus.

20. A non-invasive apparatus adapted to monitor parameters indicative of blood flow, said apparatus comprising:

At least one magnet adapted to be mounted on a limb in which blood vessels pass, and adapted to induce a magnetic flux substantially normal to the direction of the blood flow in said blood vessels;

at least two electrodes adjacent to said at least one magnet and adapted to be contiguously coupled to said limb, said at least two electrodes adapted to continuously sense induced voltage that correspond the flow of blood in said blood vessels;

a processor adapted to receive values of said induced voltage from said at least two electrodes and calculate parameters indicating blood flow;

a monitor on which the parameters indicating blood flow are displayed.

21. The apparatus as claimed in Claim 20, wherein said at least one magnet is incorporated in a resilient material shaped as a bracelet that substantially fits a person's wrist.

22. The apparatus as claimed in Claim 21, wherein a plurality of electrodes are embedded in said resilient material, and wherein said plurality of electrodes are provided with contact points that are adapted to sense voltage in a plurality of points on a line that circles about said limb.

23. The apparatus as claimed in Claim 22, wherein a band is provided adjacent to said resilient material, said band is adapted to establish and assure good contact between said plurality of contact points and said limb.

24. The apparatus as claimed in Claim 20, wherein said at least one magnet produces substantially pseudo-uniform magnetic filed across said limb.

25. An apparatus as claimed in Claim 20, wherein said at least one magnet produces substantially rotative pseudo-uniform magnetic filed across said limb.

26. The apparatus as claimed in Claim 20, wherein said processor is coupled to said at least one magnet.

27. The apparatus as claimed in Claim 20, wherein said induced voltage that is sensed by said at least two electrodes is amplified by differential preamplifiers.

28. The apparatus as claimed in Claim 27, wherein digitized results of the amplified induced voltage are transferred to said processor through a multiplexer and an A/D converter.

29. The apparatus as claimed in Claim 20, wherein said processor is provided with algorithms that comprises mathematical formulations through which hemodynamic indexes are resulted.

30. The apparatus as claimed in Claim 20, wherein said processor is provided with an algorithm based on a 2D intensity image reconstruction that outputs cross sectional images of said blood vessels, and wherein an intensity parameter in said image is indicative of blood flow velocity.

31. The apparatus as claimed in Claim 20, wherein said processor is provided with a keyboard through which instruction are transferred to said processor.

32. The apparatus as claimed in Claim 31, wherein said keyboard and said processor are miniature enough so as to be mounted with said at leas one magnet on said limb.

33. The apparatus as claimed in claim 20, wherein said monitor is a liquid crystal display that is coupled to said processor and is mounted on said limb adjacent to said at least one magnet.

34. The apparatus as claimed in Claim 20, wherein said apparatus further comprises a means for transmitting the parameters indicating heart performance to external units.

35. The apparatus as claimed in Claim 34, wherein said means for transmitting is telemetry.

36. The apparatus as claimed in Claim 34, wherein one of said external units is a storing means.

37. The apparatus as claimed in Claim 20, wherein said apparatus further comprises alarm means adapted to alert on irregularities in the blood flow.

38. The apparatus as claimed in Claim 37, wherein the alarm means is selected from the group consisting of audible alarm, visible alarm or vibrating alarm.

39. The apparatus as claimed in Claim 37, wherein the alarm is a beep sound.

40. The apparatus as claimed in Claim 37, wherein the alarm is a flashing light.

41. The apparatus as claimed in Claim 20, wherein said apparatus is provided with means through which the parameters indicating blood flow are electrically transmitted to an external processor, said external processor is electrically connected to a Holter system adapted to collect ECG signals.

42. The apparatus as claimed in Claim 41, wherein said external processor is provided with at least one algorithm, the algorithm is adapted to

correlate the data related to blood flow with the ECG signals in order to eliminate artifacts in the ECG signals.

43. The apparatus as claimed in claim 20, wherein said apparatus is powered by an adjacent power supply.

44. The apparatus as claimed in Claim 20, wherein said apparatus is further provided with a temperature sensor adapted to be used as calibration means for changes in temperatures.

45. The apparatus as claimed in Claim 20, wherein said apparatus is further provided with an ionic sensor, said ionic sensor is adapted to continuously measure changes in blood resistance due to a current induced on said blood vessel by a source electrode, and is adapted to interpret blood flow velocity from the blood resistance measurement.

46. The apparatus as claimed in Claim 20, wherein said apparatus is further provided with an inertial sensor that detects the mechanical motion of said apparatus.

47. The apparatus as claimed in Claim 20, wherein said apparatus is further provided with means for temporary venous blood occlusion.

48. A non-invasive apparatus adapted to monitor parameters indicative of blood flow velocity, said apparatus comprising:

At least one current source electrode adapted to be mounted on a limb in which blood vessels pass, and adapted to induce a current flux substantially normal to the direction of the blood flow in said blood vessels;

at least two electrodes positioned in a predetermined distance from said at least one current source and adapted to be contiguously coupled to said limb, one of said at least two electrodes is adapted to

continuously sense blood resistance and another one of said at least two electrodes is adapted to act as a reference electrode so that said at least two electrodes are adapted to measure the resistance of blood in said blood vessels;

time measuring means adapted to determine time interval between a time in which a current pulse is induced by said at least one current source electrode and a time in which a difference in resistance is sensed by said at least two electrodes;

a processor adapted to receive resistance values from said at least two electrodes and the time intervals from said time measuring means, said processor is adapted to calculate blood flow velocity;

a monitor on which blood flow velocities are displayed.

49. A non-invasive method for monitoring parameters indicative of heart performance, said method comprising:

providing a non-invasive apparatus that comprises

at least one sensor adapted to continuously sense factors correlated with blood flow and collect data related to the flow of blood, said sensor is adapted to be positioned adjacent to a peripheral blood vessel;

a processor adapted to receive the collected data from said at least one sensor and calculate the parameters indicating heart performance;

a monitor on which the parameters indicating heart performance are displayed;

mounting said apparatus on a patient's limb.

50. The method as claimed in Claim 49, wherein said method further comprises transferring said parameters indicating heart performance to a medical center.

51. The method as claimed in Claim 49, wherein said method further comprises alerting when irregularities in the blood flow are detected.

52. The method as claimed in Claim 49, wherein said method further comprises attaching a Holter device to the patient and synchronizing said parameters indicating heart performance with results from measurements performed by said Holter device.

53. A non-invasive method for monitoring parameters indicative of blood flow, said method comprising:

providing a non-invasive apparatus that comprises

at least one magnet adapted to be mounted on a limb in which blood vessels pass, and adapted to induce a magnetic flux substantially normal to the direction of the blood flow in said blood vessels;

at least two electrodes adjacent to said at least one magnet and adapted to be contiguously coupled to said limb, said at least two electrodes adapted to continuously sense induced voltage that correspond the flow of blood in said blood vessels:

a processor adapted to receive values of said induced voltage from said at least two electrodes and calculate parameters indicating blood flow;

a monitor on which the parameters indicating blood flow are displayed;

mounting said non-invasive apparatus on the patient's limb.

54. The method as claimed in Claim 53, wherein said method further comprises calculating parameters indicating heart performance from said parameters indicating blood flow.

55. The method as claimed in Claim 53, wherein said method further comprises transferring said parameters indicating heart performance to a medical center.

56. The method as claimed in Claim 53, wherein said method further comprises alerting when irregularities in the blood flow are detected.

57. The method as claimed in Claim 53, wherein said method further comprises transferring said parameters indicating blood flow to an external computer unit.

58. The method as claimed in Claim 57, wherein said method further comprises attaching a Holter device to the patient and synchronizing said parameters indicating blood flow with results of measurements performed in said Holter device.

59. The method as claimed in Claim 53, wherein said method further comprises the following steps for zeroing measurements in said apparatus

occluding temporarily venous blood in order to establish a pure artery flow;

measuring the decay in artery flow;

modeling the rate of artery decay;

estimating an average artery flow before occlusion.

60. A non-invasive apparatus adapted to monitor parameters indicative of heart performance substantially as described in the above specifications, attached Figures and appending Claims.

61. A non-invasive apparatus adapted to monitor parameters indicative of blood flow substantially as described in the above specifications, attached Figures and appending Claims.

62. A non-invasive method for monitoring parameters indicative of heart performance substantially as described in the above specifications, attached Figures and appending Claims.

63. A non-invasive method for monitoring parameters indicative of blood flow substantially as described in the above specifications, attached Figures and appending Claims.

64. A non-invasive apparatus adapted to monitor parameters indicative of blood flow velocity substantially as described in the above specifications, attached Figures and appending Claims.